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RAPPORT DU CENTRE HYDROGRAPHIQUE ET OcéANOGRAPHIQUE DE LA MARINE NATIONALE DE LA TUNISIE.

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Analysis of the tidal data in the port of Sfax

The Tunisian Naval Hydrographic and Oceanographic Center (TNHOC) maintains a tidal data base through an in-situ tide gauge network along the Tunisian coast, mainly in the ports of Bizerte, La Goulette, Kélibia, Sousse, Sfax and Zarzis (Figure 1).

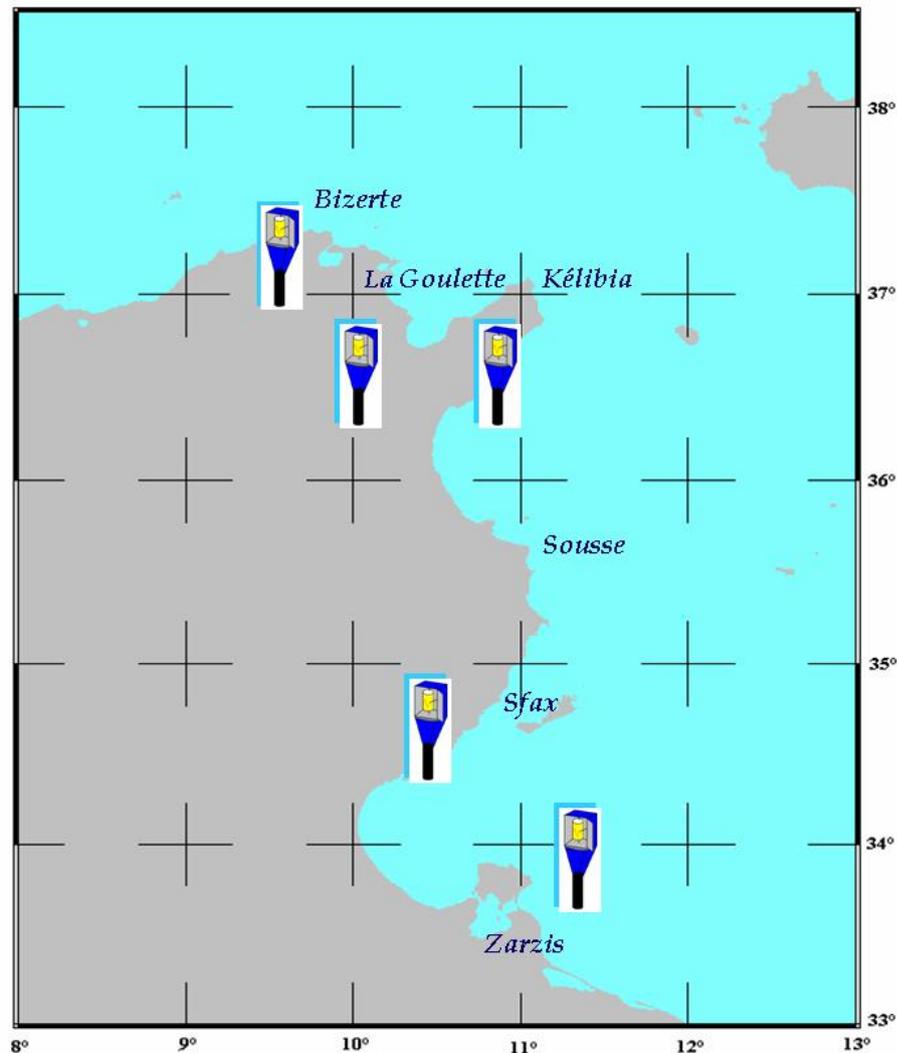


Figure 1. Map of the Tunisian tide gauge network

This network consists of floating gauges type OTTR16 (5 units) and a bottom pressure sensing instrument type YSI XSI XLM 600, which are supervised weekly by the Center personnel.

Hourly tidal data retrieved in Bizerte, La Goulette, Kélibia, Sousse, Sfax and Zarzis are stored in the Center data bank

The observatory of tide in the port of Sfax is the most important one because the tidal range is in the order of 150 centimetres.

It is to note that a previous tidal observing system was installed in 1946 by the French Hydrographic Service in the port of Sfax in order to compute its tidal ranges, harmonic constants and to elaborate the tidal prediction tables. The analysis of the tidal data acquired between 1946 and 1947 had lead to a mean sea level of 99 cm above the vertical chart datum which is the lowest low water and is 105 cm below the National Levelling Network (NLN).

In 1999, the TNHOC installed a float tide gauge in the same port which enabled the Center to collect spatiotemporal high quality data (Figure 2).

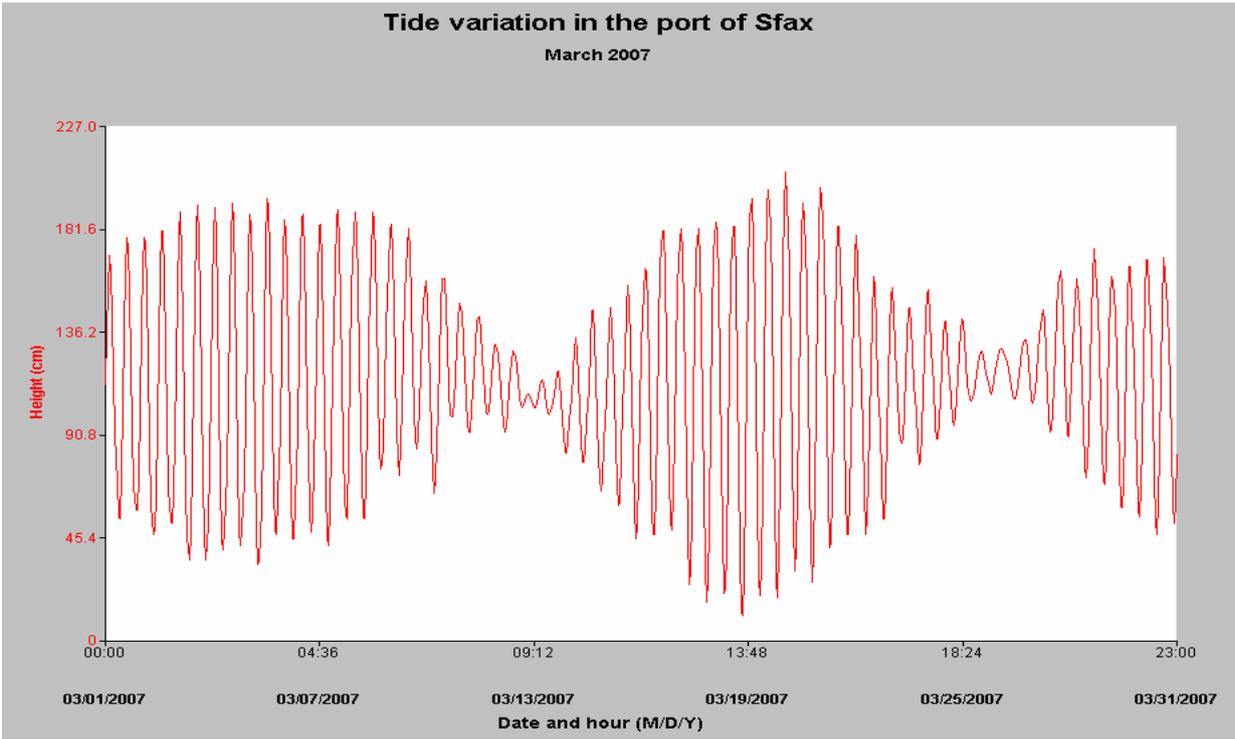


Figure 2: Tide variation in the port of Sfax

A comparison study consisting of monthly and yearly analysis of the data collected in the period of 1946-1947 and that collected in the period between 1999 and 2006 has been concluded in the Geodetic Section of the Center and gave the following results:

- 1) The mean sea level at the port of Sfax has augmented by a mean value of 17 cm during 60 years between the first and last collected data,(1946 and 2006) to reach a value of 116 cm, indicating an annual increase of 2.8 ± 0.2 mm/year (Figure 3).

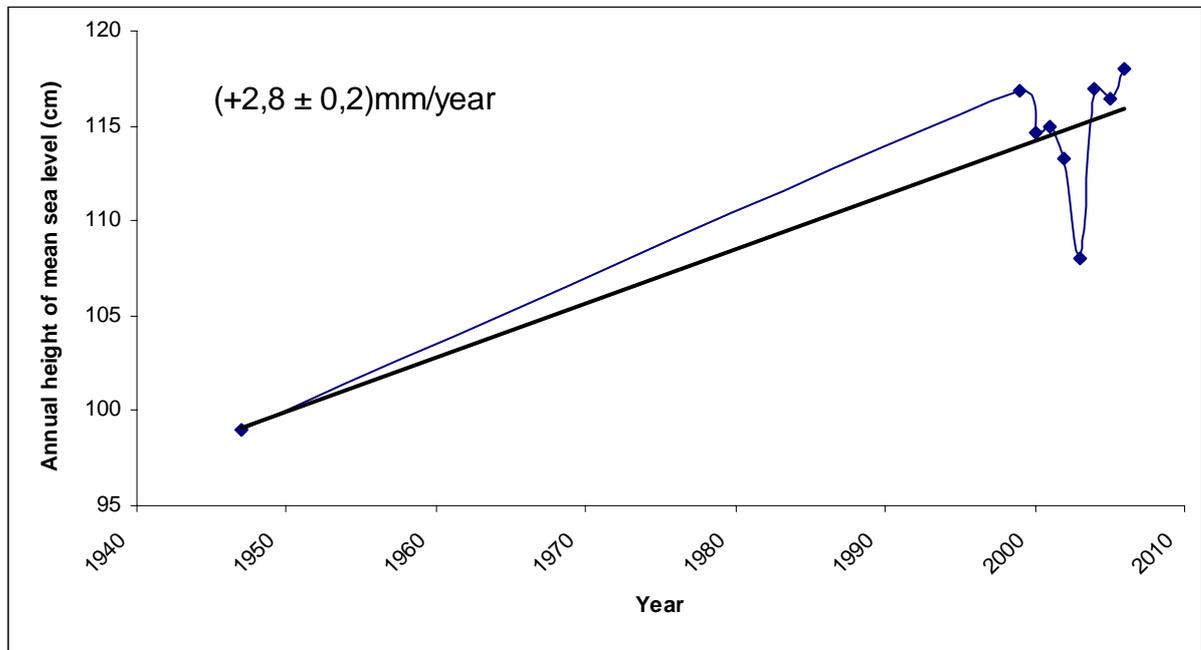


Figure 3: Yearly mean sea levels in the port of Sfax

- 2) During the period of 8 years (1999-2006), the lowest low tide fell twice 1 cm below the chart datum at that location, first in April 2004 and then in February 2005 (Figure 4).

As a matter of fact, while consulting meteorological bulletins for those periods at this location (South of Tunisia), we concluded that those declines in the water level below the chart datum may be related to the anticyclonic systems which occurred in the same periods.

The same phenomenon was observed at the port of Zarzis where the lowest level of water was recorded during the same time, and also was below chart datum.

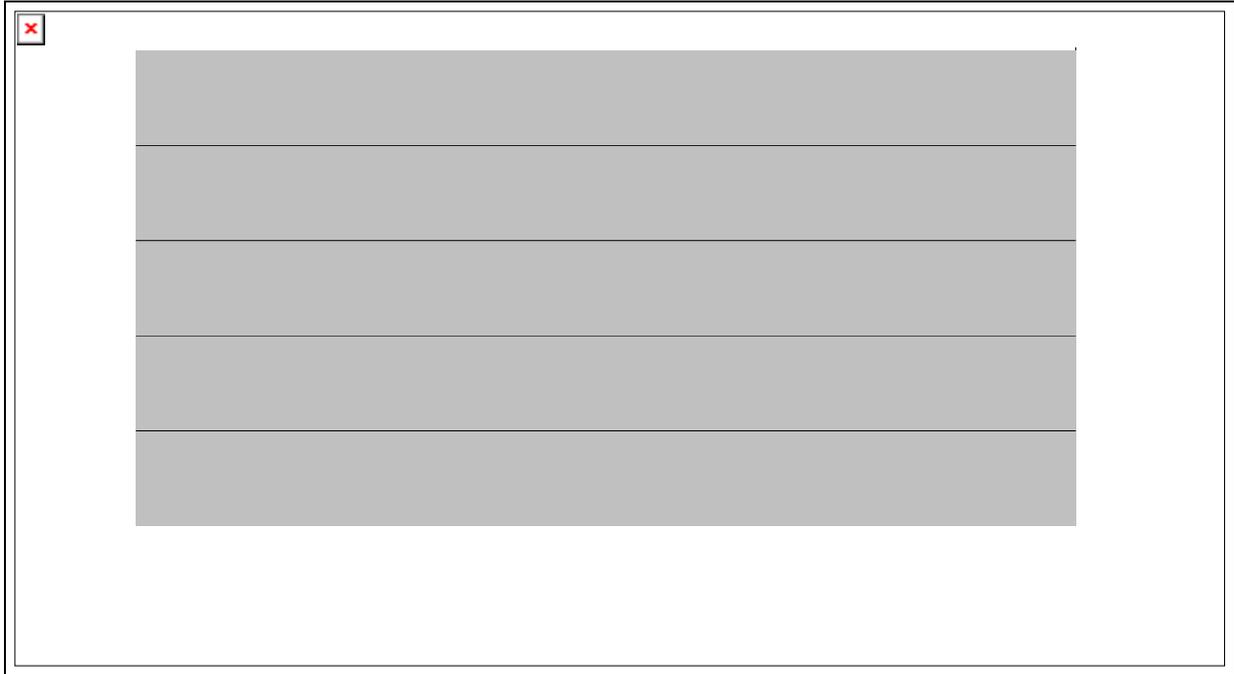


Figure 4: Yearly mean sea level and extreme sea levels in the port of Sfax

3) The mean sea level seasonal variations has a maximum range of 25 cm along the year, with a maximum positive deflection in the fall (+15cm in October), a minimum deflection in the spring (≈ 0 cm in March), and a maximum negative deflection in the winter(- 10 cm in December) (Figure 5) .

We also observe a quick rise in summer and a fast decrease in winter.

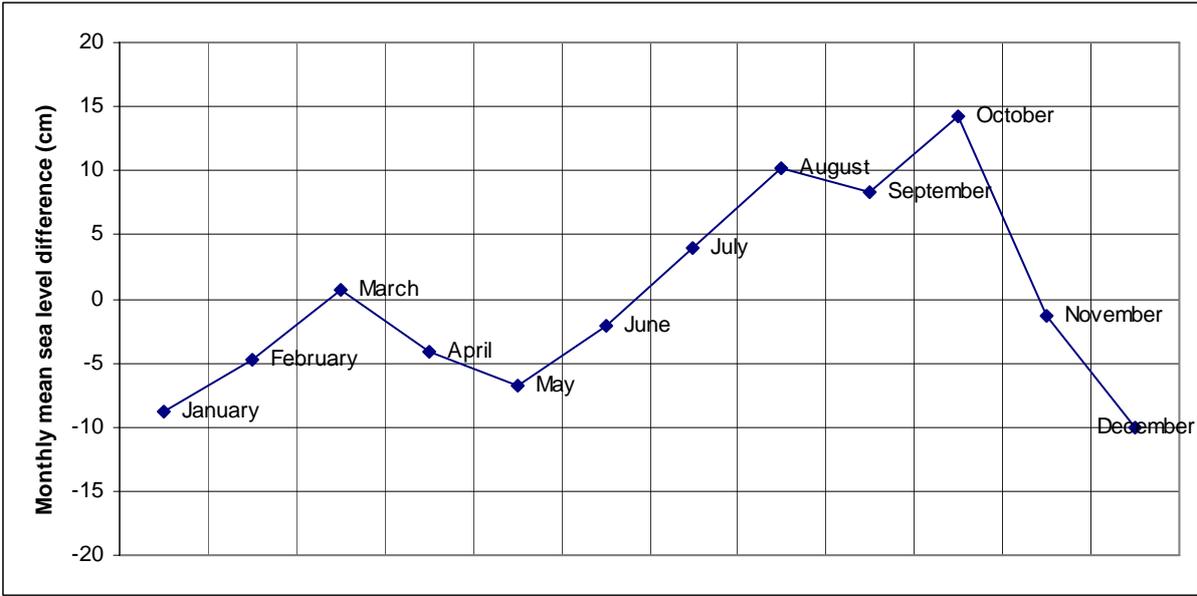


Figure 5: Mean sea level variations during 2006 in the port of Sfax

- 4) Using the tidal harmonic constants computed by the French Hydrographic Service in 1951 from the observed tidal data of 1946-1947, implemented in the SHOMAR software of the same Service, a difference reaching 30 cm is obtained between the predicted and the observed tide.

Since the mean sea level has increased during these last 60 years, and since the tidal constituents drift in time, these differences in heights are justified.

All mentioned results agree well with the analysis of the Topex Poseidon satellite observations of the Mediterranean Sea Level. In fact, these observations collected from January 1993 to September 2004 estimated a yearly variation of the mean sea level at Sfax port between 2.5 and 5mm. (Figure 6)

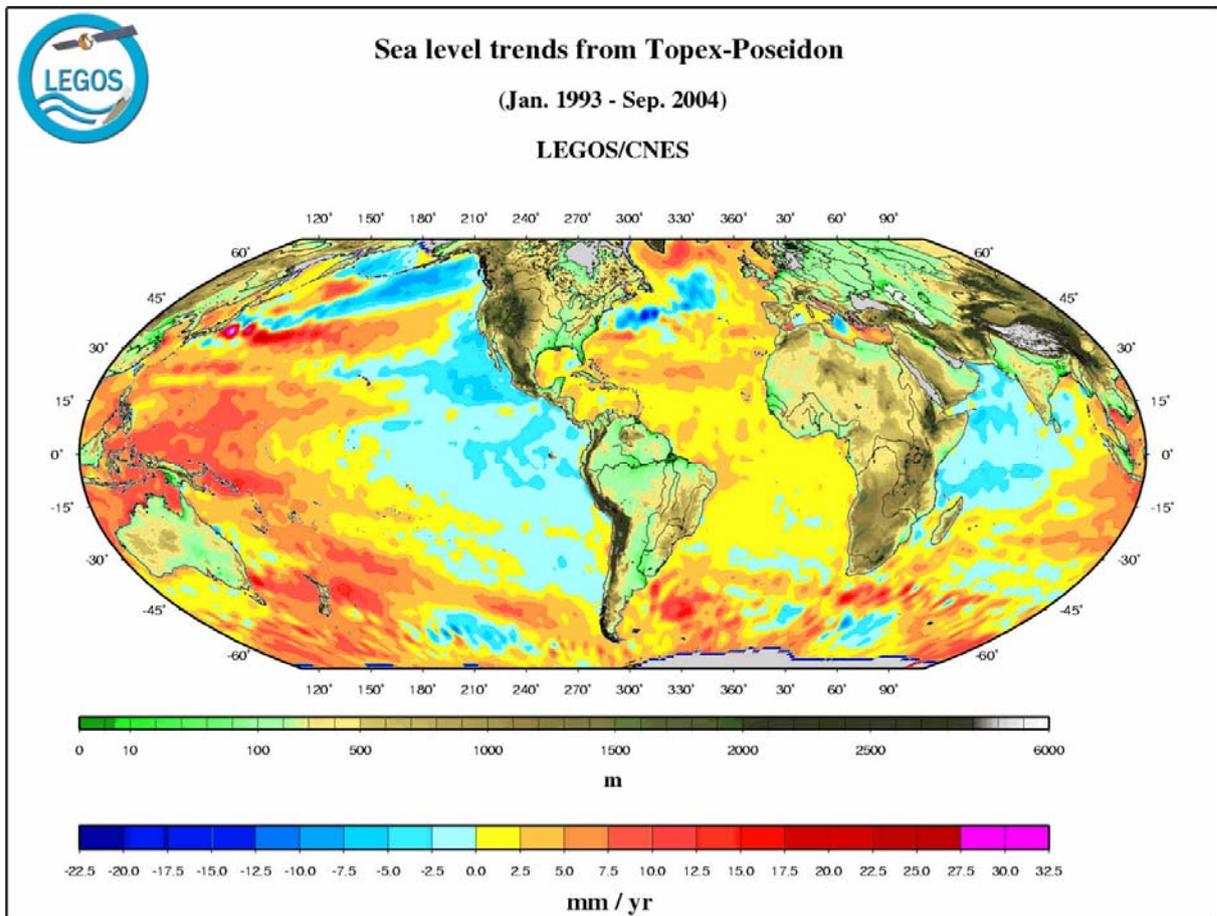


Figure 6: Variation rate of the mean sea level (http://www.legos.obs-mip.fr/en/produits/grand-public/images//sealevel_2.png)